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(54) **ROTATING ARC FAULT-CURRENT INTERRUPTER**

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Related U.S. Application Data

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(51) **Int. Cl.**[7] **H01H 9/44**
(52) **U.S. Cl.** **218/29**; 218/23; 218/154
(58) **Field of Search** 218/23, 26, 29, 218/37, 38, 40–42, 16–22, 146, 148, 153, 154

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5,464,956	A	*	11/1995	Steele et al.	218/29

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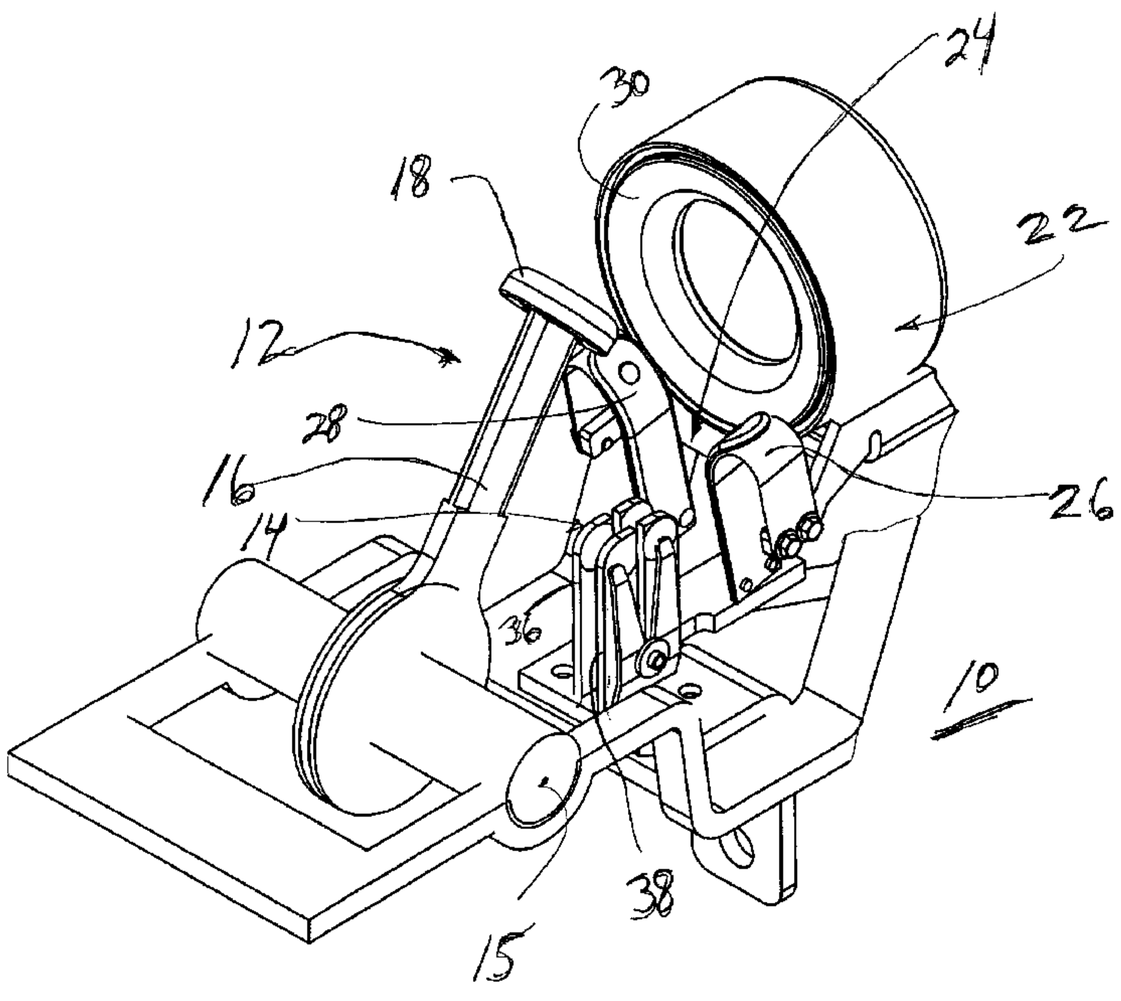
(57) **ABSTRACT**

A rotating arc fault-current interrupter, also known as an arc spinner interrupter, is provided that establishes an easily visible open gap via a movable blade member having a first portion for engaging a stationary main contact and a second portion formed by an arcing electrode for engaging an auxiliary contact associated with an arc spinner assembly. The geometry, orientation and placement of the auxiliary contact is such that during opening of the movable blade member, the arcing electrode remains engaged with the auxiliary contact after the blade member and the stationary main contact are separated from each other whereby current is transferred through the auxiliary contact into the arc spinner assembly, i.e. the current is commutated into the arc spinner assembly. Thus, the current in the arc spinner creates a magnetic field to cause the arcing current to rotate rapidly so as to extinguish the arc as the arcing electrode separates from the auxiliary contact and moves to the opened position whereby a visible open gap is established that is easily visible without any obstructions from a range of viewing angles or orientations.

7 Claims, 4 Drawing Sheets



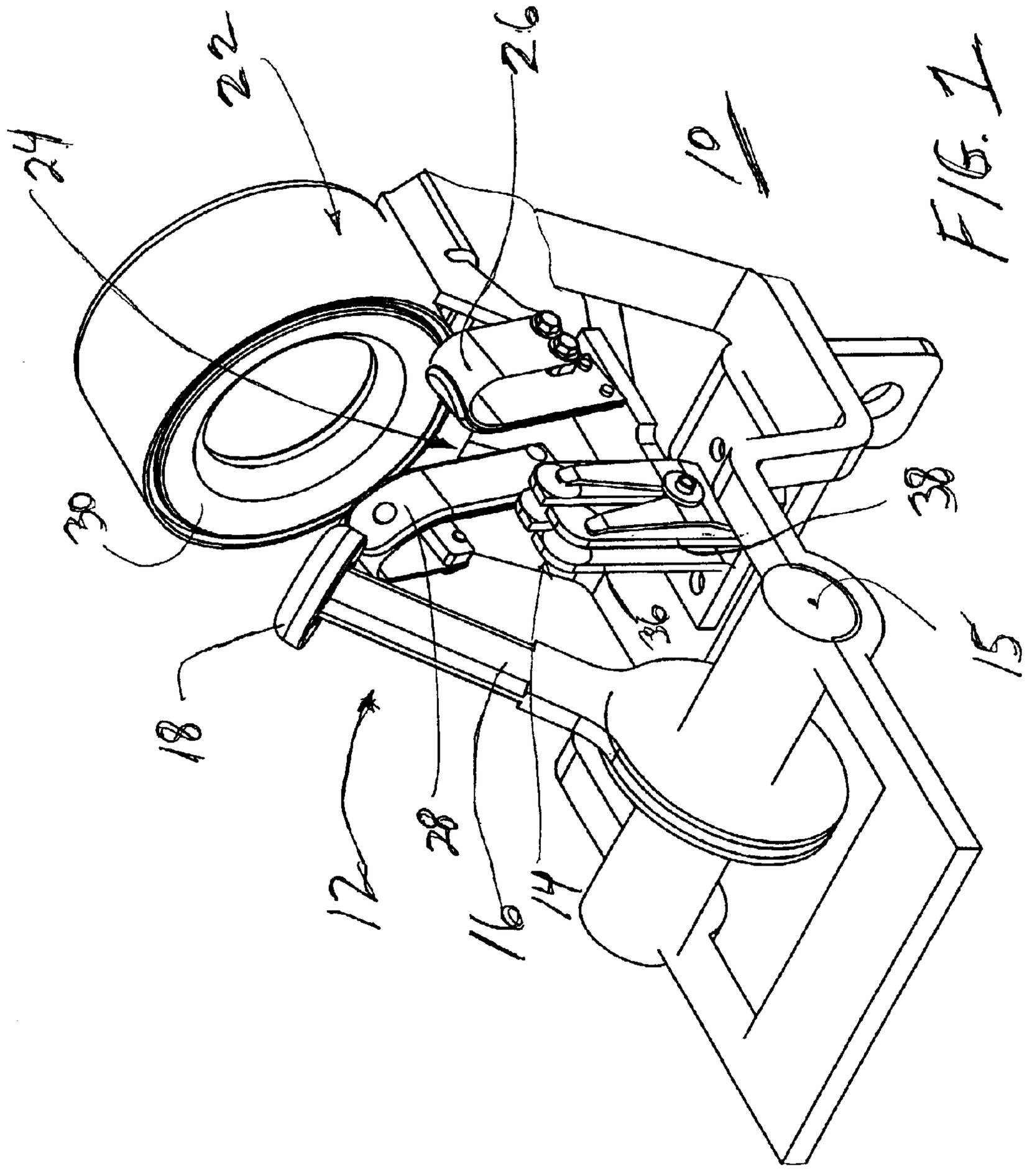


FIG. 1

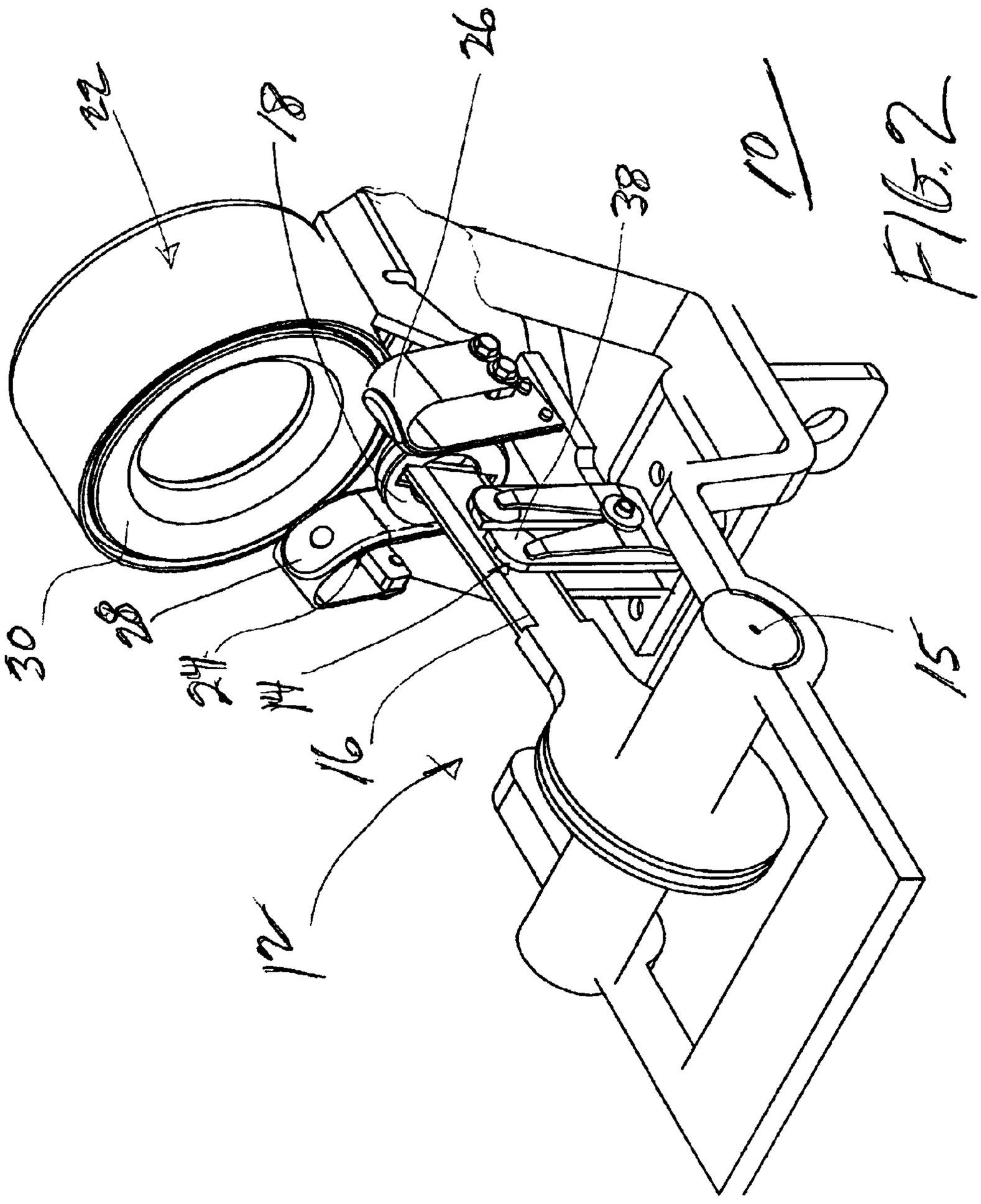


FIG. 2

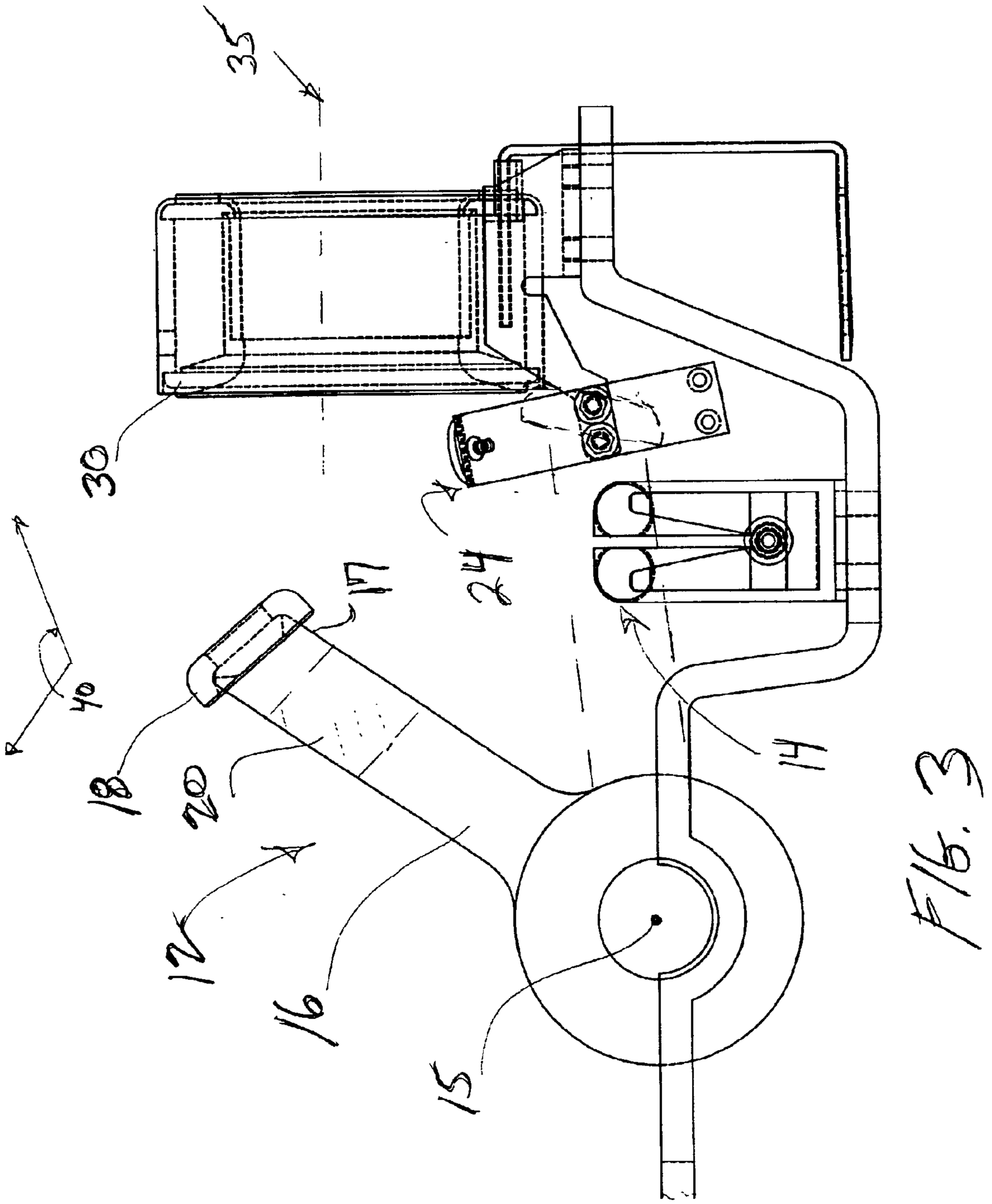


FIG. 3

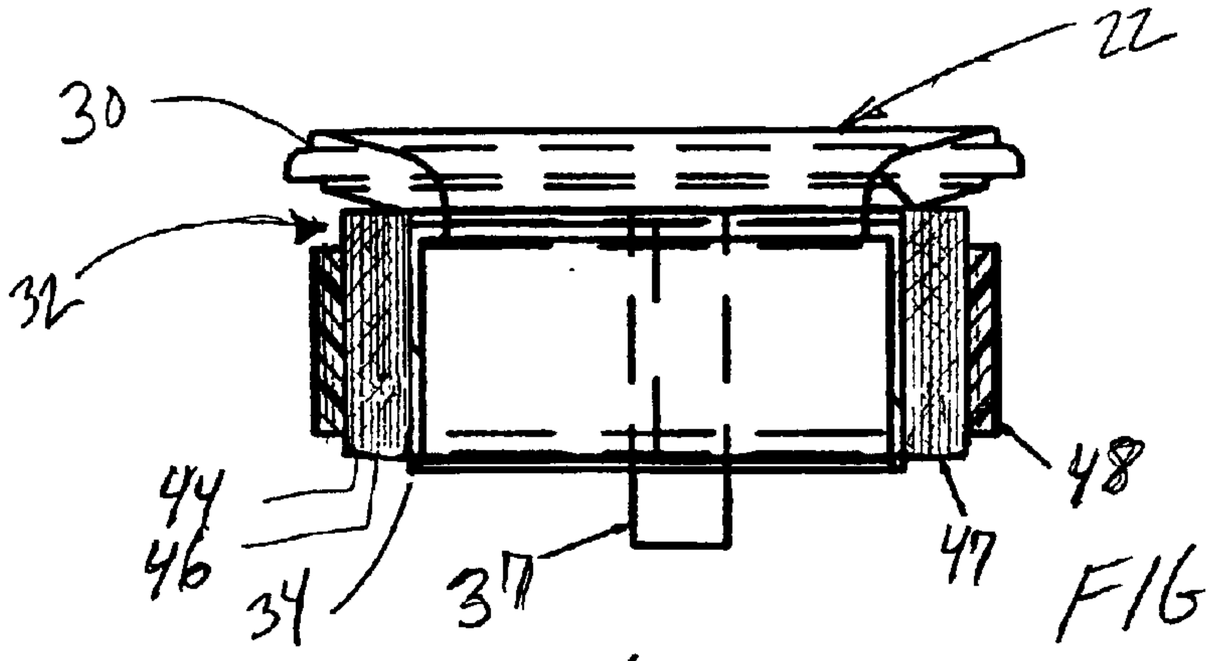


FIG. 4

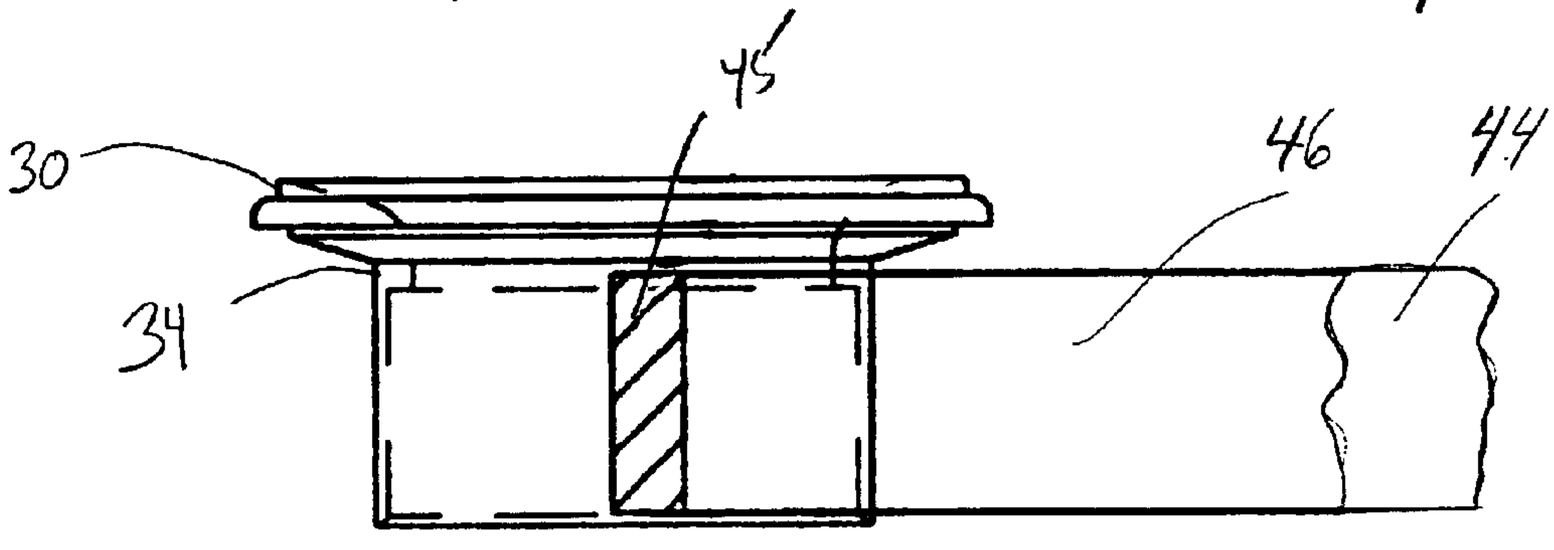


FIG. 5

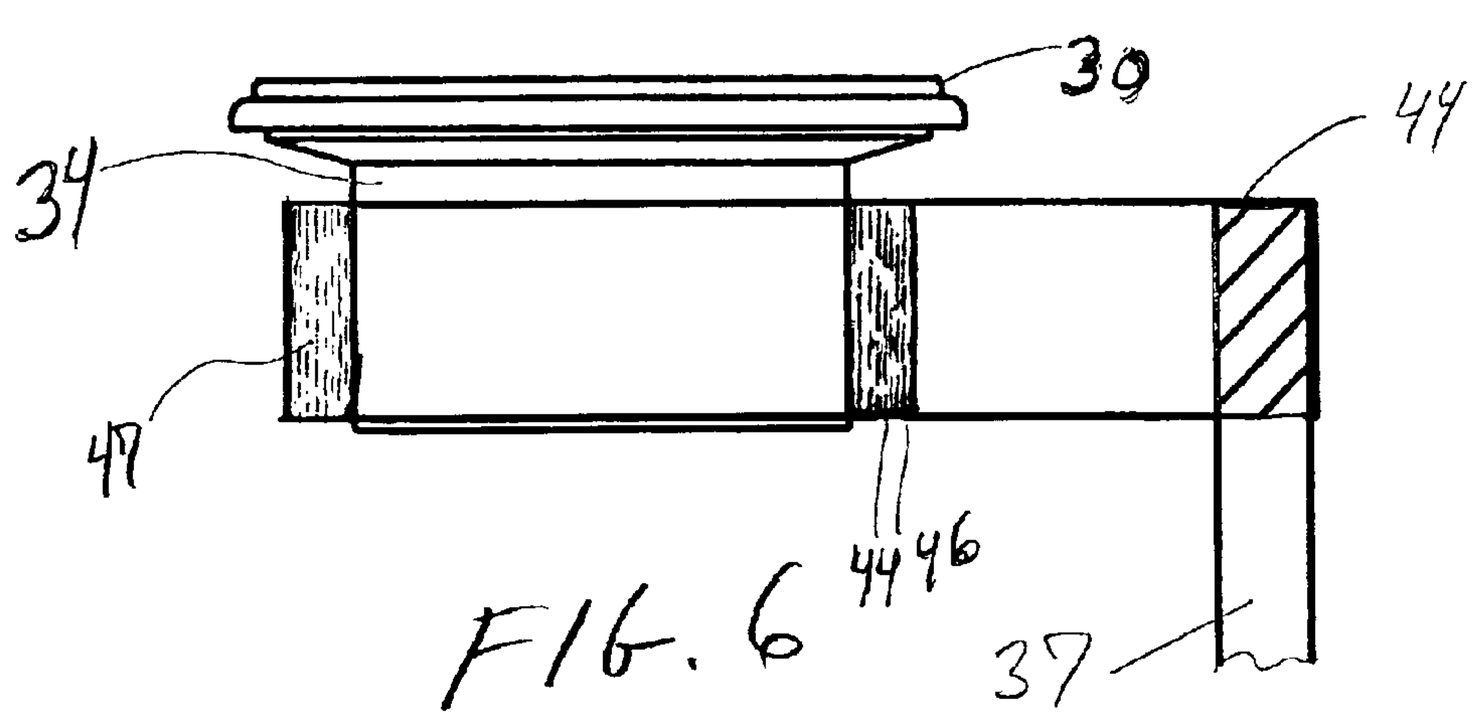


FIG. 6

ROTATING ARC FAULT-CURRENT INTERRUPTER

This application claims the benefit of U.S. Provisional Application No. 60/350,518 filed on Oct. 22, 2001.

BACKGROUND OF THE INVENTION

The present invention relates generally to current-interrupting devices for electrical power distribution systems and more particularly to a rotating arc fault-current interrupter that establishes an easily visible open gap.

Various interrupting devices including rotating arc interrupters have been proposed that utilize magnetic fields to perform their functions. For example, see the following U.S. Pat. Nos. 4,409,446; 4,529,853; 5,003,138 and 5,464,956.

While the prior art arrangements may be useful to provide current interrupting devices for general purposes and for use in circuit breakers, these arrangements are relatively large and cumbersome and do not lend themselves for use in distribution switchgear where small size and the visibility of an open switch gap is desirable.

SUMMARY OF THE INVENTION

Accordingly, it is a principal object of the present invention to provide a rotating arc fault-current interrupter that is small and provides an easily visible open gap.

It is another object of the present invention to provide a rotating arc interrupter having a movable contact blade having a first portion for engaging a stationary main contact and a second portion for engaging an auxiliary contact associated with an arc spinner assembly.

These and other objects of the present invention are efficiently achieved by the provision of a rotating arc fault-current interrupter, also known as an arc spinner interrupter, that establishes an easily visible open gap via a movable blade member having a first portion for engaging a stationary main contact and a second portion formed by an arcing electrode for engaging an auxiliary contact associated with an arc spinner assembly. The geometry, orientation and placement of the auxiliary contact is such that during opening of the movable blade member, the arcing electrode remains engaged with the auxiliary contact after the blade member and the stationary main contact are separated from each other whereby current is transferred through the auxiliary contact into the arc spinner assembly, i.e. the current is commutated into the arc spinner assembly. Thus, the current in the arc spinner creates a magnetic field to cause the arcing current to rotate rapidly so as to extinguish the arc as the arcing electrode separates from the auxiliary contact and moves to the opened position whereby a visible open gap is established that is easily visible without any obstructions from a range of viewing angles or orientations.

BRIEF DESCRIPTION OF THE DRAWING

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in conjunction with the accompanying drawing in which:

FIG. **1** is a perspective view of a rotating arc fault-current interrupter switch in accordance with the principles and features of the present invention, and shown in the opened position;

FIG. **2** is a perspective view of the rotating arc interrupter switch of FIG. **1** shown in the closed position;

FIG. **3** is a rear elevational view of the rotating arc interrupter of FIG. **1**;

FIG. **4** is a sectional view of the arc spinner assembly of the rotating arc fault-current interrupter of FIGS. **1–3**; and

FIGS. **5** and **6** are elevational views of the arc spinner assembly of FIGS. **1–4** illustrating fabrication of a specific embodiment.

DETAILED DESCRIPTION

Referring now to FIGS. **1–3**, a fault-current interrupter switch **10** that is illustrative of the principles of the present invention includes a movable contact assembly **12** and a stationary main contact **14**, the movable contact assembly **12** being movable between respective opened (FIG. **1**) and closed (FIG. **2**) positions with respect to the stationary main contact **14**. The closed position is also shown by dashed lines in FIG. **3**. In a specific arrangement, the movable contact assembly **12** is pivotally mounted for movement about an axis **15**. The movable contact assembly **12** includes a blade member **16** carrying an arcing electrode **18** at the end of the blade member **16**. A first predetermined portion **20** (FIG. **3**) of the blade member **16** engages the stationary main contact **14** as the movable contact assembly **12** moves to the closed position as shown in FIG. **2**. The interrupter switch **10** also includes a generally cylindrical arc spinner assembly **22** and an auxiliary contact **24** that is in engagement with the arcing electrode **18** when the movable contact assembly **12** is in the closed position as shown in FIG. **2**. The auxiliary contact **24** may also be characterized as a shunt contact. The auxiliary contact **24** is electrically connected to the arc spinner assembly **22**.

The geometry, orientation and placement of the auxiliary contact **24** is such that during opening of the movable contact assembly **12**, the arcing electrode **18** remains engaged with the auxiliary contact **24** after the blade member **16** and the stationary main contact **14** are separated from each other whereby current is transferred through the auxiliary contact **24** into the arc spinner assembly **22**, i.e. the current is commutated into the arc spinner assembly **22**. For example, as shown in FIGS. **1–3**, the auxiliary contact **24** extends farther along the path of movement of the blade member **16** than does the stationary main contact **14**. Thus, the current in the arc spinner creates a magnetic field to provide an arc spinner so as to extinguish the arc as the arcing electrode **18** separates from the auxiliary contact **24** and moves to the opened position of FIG. **1** whereby a visible open gap is established. For example, as shown in FIG. **3**, a clear indication of a visible open gap is provided without any obstructions as illustrated by a range of typical viewing angles or orientations referred to at **40**. That is, with this arrangement, blade member **16** with arcing electrode **18** moves away from the arc spinner assembly **22** so as to be clearly separated therefrom.

This fault-current interrupter switch **10** has been found suitable to interrupt fault currents of 12,500 amperes at 15.5 kV. Additionally, a multi-phase arrangement of such fault-current interrupter switches **10** may be provided with an approximate spacing of five inches phase-to-phase, e.g. supported within and separated by insulating sheets, as illustrated in more detail in U.S. Pat. No. 5,864,107. This may be accomplished in an environment of an insulating gas, e.g. in SF-6 gas with pressures as low as 5–10 psig.

In the illustrative geometry of FIGS. **1–3**, the stationary main contact **14** and the auxiliary contact **24** are generally aligned with respect to the path of the movement of the blade member **16**, the stationary main contact **14** being positioned

nearer to the axis **15** of the blade member **16** than the auxiliary contact **24**, while the auxiliary contact **24** extends to a position nearer the leading edge **17** of the blade member **16**. The blade member **16** defines a plane of movement between the closed and opened position. The pivotal mounting axis **15** is perpendicular to this plane. Additionally, the arc spinner assembly **22** defines a central axis **35** that is in the plane of defined by the movement of the blade member **16**. Further, the stationary main contact **16** and the auxiliary contact **24** are also in the plane defined by the movement of the blade member **16**.

In the illustrative arrangement of FIGS. **1–3**, the auxiliary contact **24** is formed by two arm members **26, 28** that are flexible and spaced apart for suitable contact with the arcing electrode **18**. Further, in the illustrative arrangement, the stationary main contact **14** is formed by two resiliently biased jaw contact arms **36, 38** to provide suitable contact pressure when engaged with the first predetermined portion **20** of the blade member **16**. The arc spinner assembly **22** includes a conductive arc runner surface or ring **30** and an electrically connected coil assembly **32**.

Referring now additionally to FIGS. **4–6** and considering a specific illustrative embodiment of the arc spinner assembly **22**, the coil assembly **32** of the arc spinner assembly **22** is formed by electrically attaching a conductive strip **44** at **45** to the elongated cylindrical portion **34** of the arc spinner assembly **22**, and then winding the conductive strip **44** along with an insulating strip **46** about the cylindrical portion **34** to form a coil via a plurality of turns or revolutions (e.g. approximately 15 turns) about the portion **34** as shown in FIG. **6** at **47** and providing an electrical coil output lead at **37** for connection to the auxiliary contact **24** and the stationary main contact **14**. In a specific embodiment, after the turns of the conductive strip **44** along with the interposed turns of the insulating strip **46** are wound to form the coil **47**, tape **48** is wrapped around the coil **47** to retain the coil **47**. In a specific implementation, the conductive strip **44** is C-110 having an approximate thickness of 0.016 inches, the insulating strip **46** strip is woven glass material having an approximate thickness of 0.006 inches, and the tape **48** is Permacell glass-filled tape, type P-21.

While there have been illustrated and described various embodiments of the present invention, it will be apparent that various changes and modifications will occur to those skilled in the art. Accordingly, it is intended in the appended claims to cover all such changes and modifications that fall within the true spirit and scope of the present invention.

What is claimed is:

1. An interrupter comprising:

movable contact means movable between open and closed positions;

a stationary contact being engaged by said movable contact means in said closed position;

an auxiliary contact being spaced from said stationary contact and being in engagement with said movable contact means during separation of said movable contact means from said stationary contact; and

magnetic field generating means responsive to current through said auxiliary contact for generating a magnetic field to extinguish arcing currents, said movable contact means comprising a blade member having a first portion for engagement with said stationary contact and a second portion for engagement with said auxiliary contact such that said first portion does not engage said auxiliary contact, said auxiliary contact being electrically connected to said magnetic field generating means.

2. The interrupter of claim **1** wherein said auxiliary contact and said stationary main contact are arranged such that upon opening of said blade member, said blade member remains in engagement with said auxiliary contact after said blade member separates from said stationary contact member.

3. The interrupter of claim **1** wherein said auxiliary contact is disposed intermediate said stationary main contact and said magnetic field generating means.

4. The interrupter of claim **1** wherein said blade member is pivotally mounted at a first end thereof, and said first portion of said blade member is intermediate said first end and said second portion of said blade member.

5. The interrupter of claim **4** wherein said second portion is an arcing electrode carried at a second end of said blade member.

6. The interrupter of claim **1** wherein said magnetic field generating means comprises an arc spinner.

7. The interrupter of claim **6** wherein said arc spinner comprises a coil including a plurality of winding turns defined by the interleaving of a conductive strip and an insulating strip.

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